Space Weather Technical Forecast

Issued on Wednesday, 21 August 2024 at 13:06 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: R1/R2 flares expected, chance of R3 flares, risk reducing slightly. Slight chance of G1/Minor Storms from late Day 1 (21 Aug). Chance of exceeding S1/Minor Radiation Storm.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Moderate, with two M-class flares recorded in the last 24 hours, with a peak flare of M1.3 at 20/1708UTC from AR3785.

There are thirteen regions on the visible disc, including two unnumbered regions in the southeast. The three largest and most complex regions on the disc are AR3784, AR3790 and AR3796. AR3784 has almost now rotated over the northwest limb. AR3790 approaching centre disc in the south has shown some consolidation in its intermediate spots in recent hours. AR3796 in the southeast has shown some fragmentation in its intermediate portion in most recent imagery. The other sunspot regions are comparatively smaller or less complex, and either stable or in slight decay.

A filament lift-off near AR3793 around 20/1708UTC is now assessed as not producing a CME (Coronal Mass Ejection). No other Earth directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by ACE at L1, showed a slow regime. The solar wind speed varied between around 300-350km/s. The density was below average. The Interplanetary Magnetic Field was weak, below 8nT. The north-south component varied weakly but was often southward directed, between +5/-6nT The phi angle was mostly positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels.

High energy electron flux (greater than 2MeV) observed at GOES16 was at background levels. The 24-hour fluence was below the Active threshold, with 1.15e6 integrated pfu observed at 21/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: M-class flares are expected with a chance of X-flares, however the departure of AR3784 should see a slight dip in daily risks.

Solar Wind /Geomagnetic Activity: The geomagnetic forecast is of lower-than-average confidence in detail for this period. A CME occurring around 17/1030UTC has a small chance of giving glancing impacts late on Day 1 (21 Aug). A filament lift-off near AR3793 around 20/1708UTC is now assessed as not producing a CME.

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Some HSS influence from CH60/+ is likely early on Day 2, perhaps combining with the CME from 17 August. A second fast wind from a similarly minor coronal hole (CH61/+) may arrive around 24-36 hours after the onset of CH60/.

Largely Quiet activity is expected at first, perhaps increasing to Unsettled to Active with a chance of G1/Minor Storm intervals from later Day 1 with potential CME and HSS features.

Energetic Particles / Solar Radiation: High energy proton flux is likely to remain at background levels, with a chance of exceeding the S1/Minor solar radiation storm level should any notable flares occur.

High energy electron flux is expected to remain at background levels. The associated 24-hour fluence is expected to be below the Active level.

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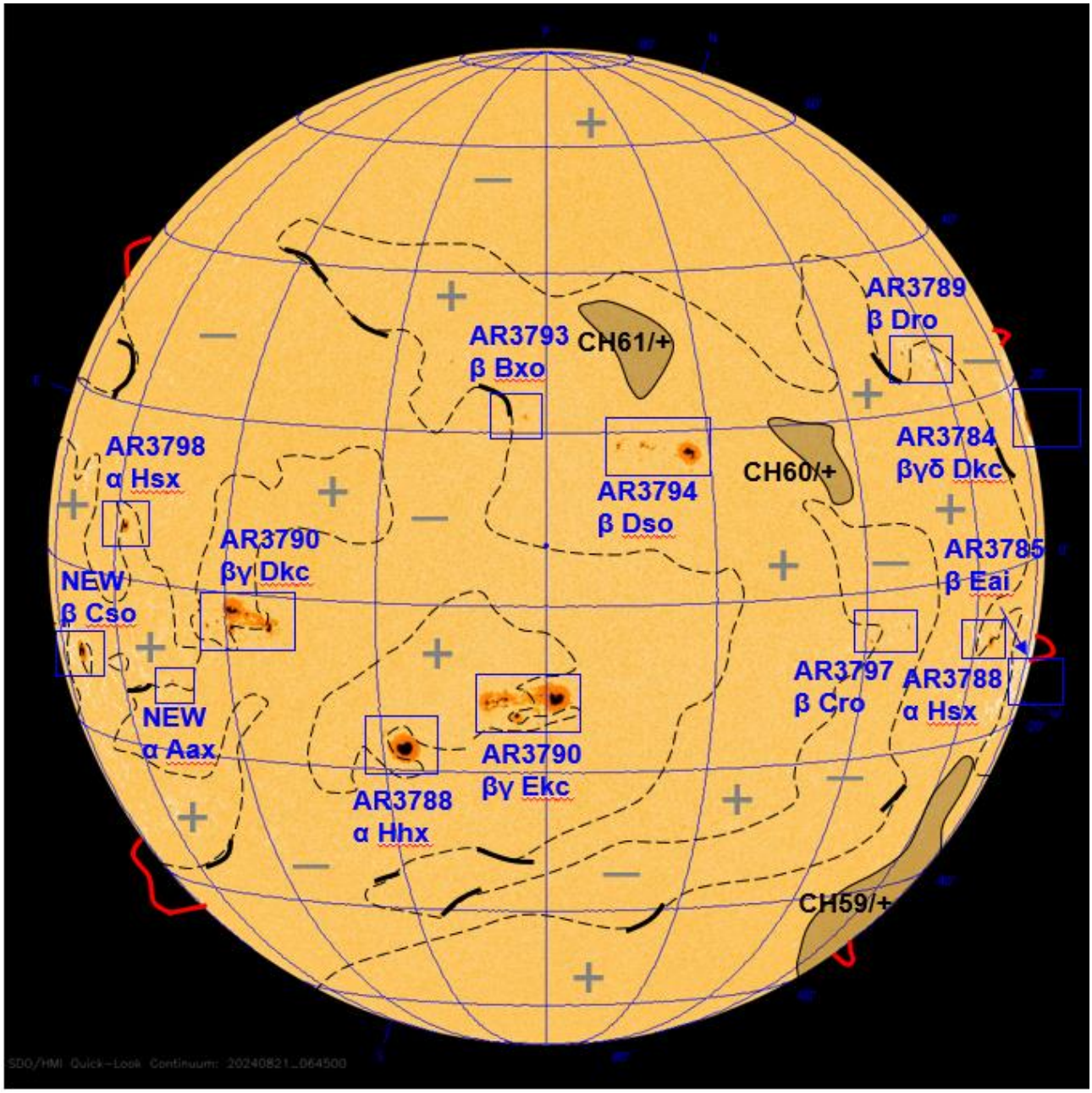
Figure 1. Solar Analysis Valid 21/0700UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

The geomagnetic forecast is of lower-than-average confidence in detail for this period. The reasons for uncertainty are: the large number of minor transients observed in coronagraph imagery; the marginal nature of a potentially inbound CME; and finally due to the altering shape of the two coronal holes, CH60/+ and CH61/+. There was some potentially High Speed Stream (HSS) related influence on the last rotation, although with an uncertain source at that time as no coronal holes were visible on the disc.

A CME emerged from a broad upper coronal reconfiguration, occurring around 17/1030UTC across a large span of 40N. This resultant CME is most likely to stay above the ecliptic plane, but has a small chance of giving glancing impacts later on Day 1 (21 Aug) or early Day 2(22 Aug) - particularly should it interact with the fast wind from CH60/+.

A filament lift-off near AR3793 around 20/1708UTC is now assessed as not producing a CME.

Some HSS influence from CH60/+ is likely early on Day 2 (22 Aug), perhaps combining with the CME from 17 August, although with low confidence in the arrival time and peak wind speeds. A second fast wind from a similarly minor coronal hole (CH61/+) may arrive around 24-36 hours after the onset of CH60/

Largely Quiet activity is expected at first, perhaps increasing to Unsettled to Active with a chance of G1/Minor Storm intervals from later Day 1 with potential CME and HSS features.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	25	25	25	25
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
17/2001	Partial	High coronal	40N across centre disc	368 km/s	Crosses 1AU 21/1200 UTC	Possible, low confidence, may interact with CH60/+

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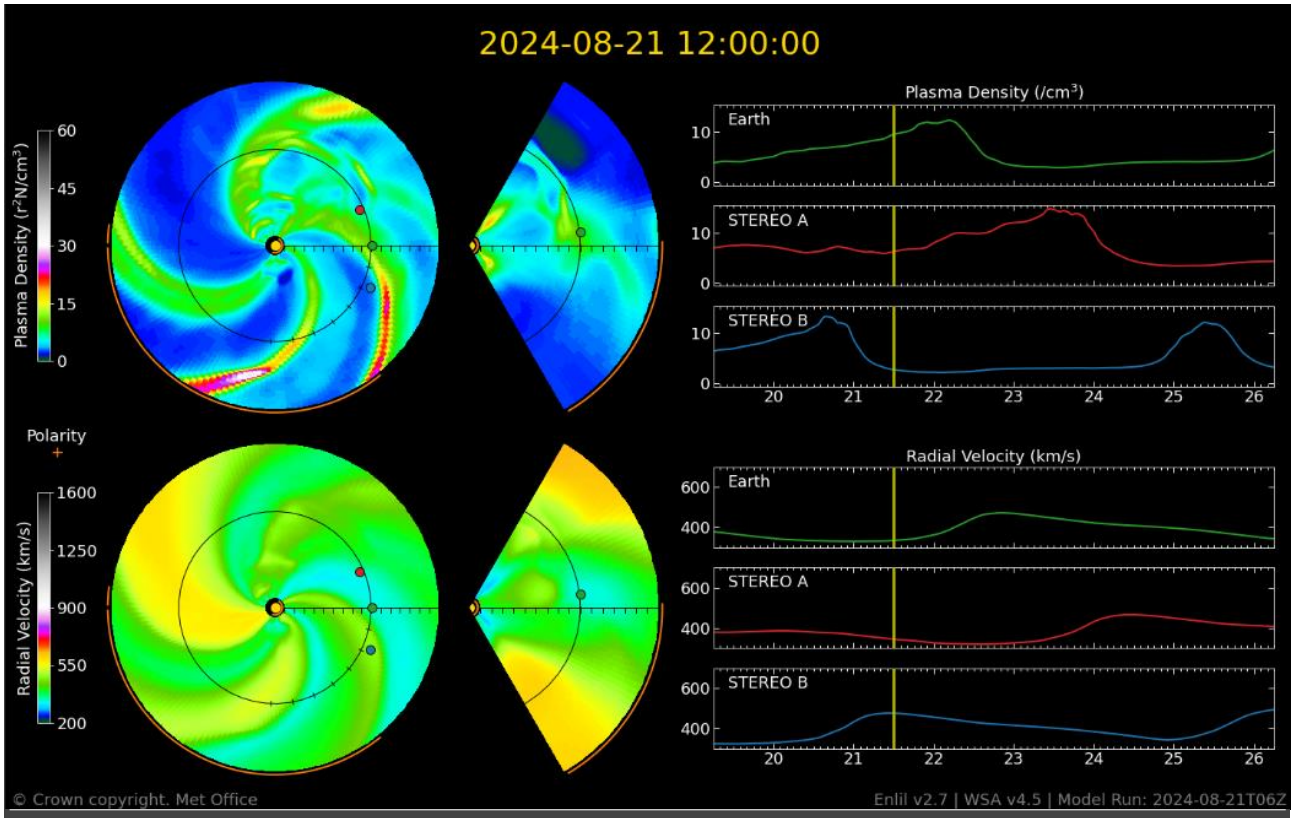
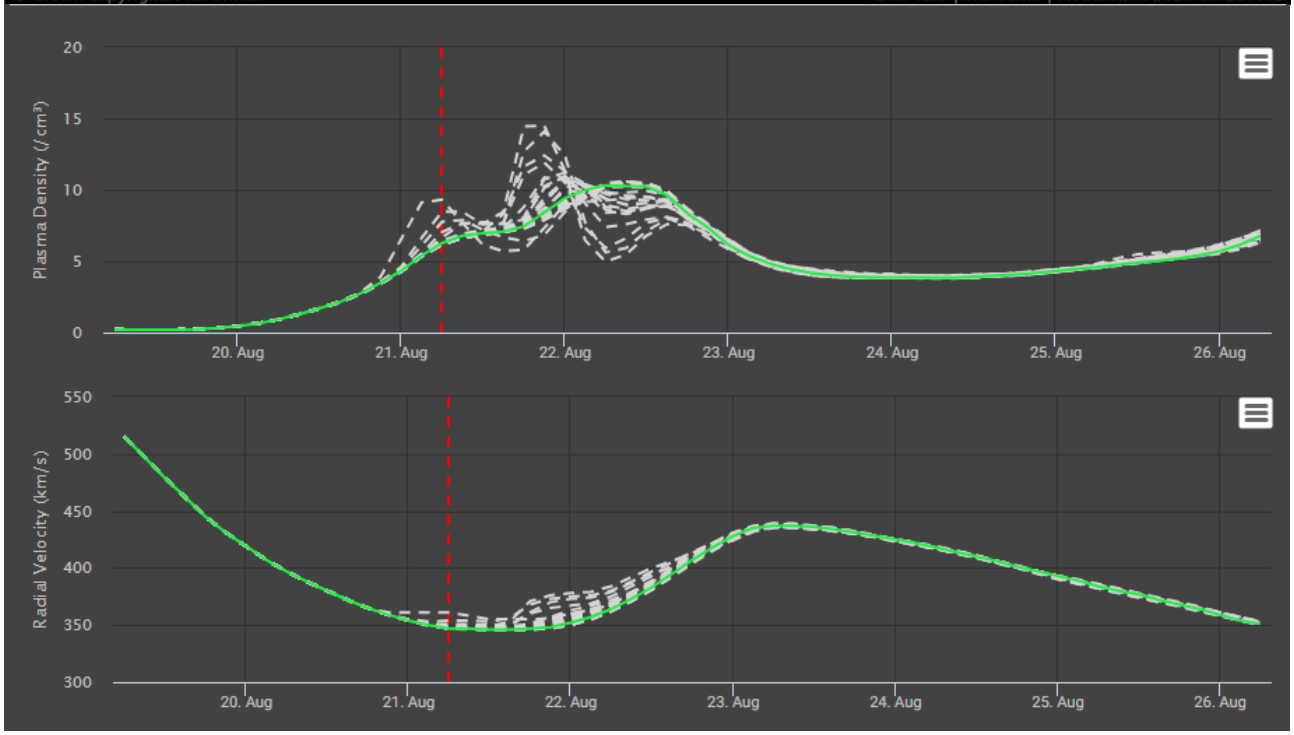
Figure 2: MOSWOC Enlil and ensemble showing potential CME and HSS features.





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Radio Blackouts - X-Ray Flares:

There are thirteen regions on the visible disc, including two unnumbered regions in the southeast. The three largest and most complex regions on the disc are AR3784, AR3790 and AR3796. AR3784 has almost now rotated over the northwest limb. AR3790 approaching centre disc in the south has shown some consolidation in its intermediate spots in recent hours. AR3796 in the southeast has shown some fragmentation in its intermediate portion in most recent imagery. The other sunspot regions are comparatively smaller or less complex, and either stable or in slight decay.

Further M-class flares are anticipated, with a possibility of isolated X-class flares, mainly originating from AR3784, AR3790, and AR3796. However the trend in X-ray activity should be slightly downward over the four days as AR3784 rotates off the disc on Days 1-2 (21-22 Aug). Additionally, few new regions are signalled to arrive over the eastern horizon from far-side soundings or returning regions.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	80	75	60	60
Very Active	R3 to R5 X Class	No	25	20	15	15

Solar Radiation Storms - (High Energy Protons):

High energy proton flux at GOES18 is likely to persist at background levels, but with a chance of rising in response to any notable flares.

AR3784 approaching the northwest limb is the main region of interest for proton flux risk at present, with this risk slowly reducing once it gets well past the limb later in this period. However, AR3790 is due to rotate into the western disc on Day 1 (21 Aug), with a gradually increasing risk of proton events from this feature which will partially balance the reducing risk from AR3784.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	25	25	25	25
Very Active	≥ S3 *	No	5	5	5	5
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons Event (≥ 2MeV):
The high energy electron forecast is of low confidence. Current background electron flux levels are now considered likely to remain that way after recent CME effects, as the solar winds have now returned to background levels. Upcoming potential CME and HSS influence is expected to keep flux levels at background throughout the period.

As such, the fluence is expected to remain below the Active (1e8 integrated pfu) through the rest of this period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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